

published), and Portugal as the other parts. Of the fifty-eight parts projected, twenty-one were shown as published when the present volume appeared; but these treat mostly of the smaller European countries and of regions beyond Europe, while the parts to be devoted to Germany, Austria, Hungary, etc., not to speak of those relating to France, Italy, Belgium, Switzerland, etc., were still lacking. This suggests that the German plans, in this as in other matters, have been found easier than the German performance.

For what we have received, however, let us be thankful. In the present part we have a most useful and authoritative summary of our geological knowledge of the homelands. The local editor, Dr. J. W. Evans, has skilfully selected his team, who have dealt individually with the formations on which they have specialised, and possess the fullest and latest information. There is, of course, some unevenness of treatment, but the general scheme is coherent throughout. The classification, subdivision, and local variation of each system in turn are broadly described without much local detail, and illustrated by sketch-maps and sections (mostly reproduced from previous publications, but here conveniently assembled) and by full correlation-tables. The names of the authors of the chapters are sufficient guarantee for the quality of the work. Prof. W. W. Watts deals with the pre-Cambrian, Cambrian, and Ordovician rocks of England; Prof. J. W. Gregory with the pre-Cambrian of Scotland, as well as with the morphology; Dr. A. Harker with the igneous rocks, in a series of short articles under the formational headings; Dr. A. Morley Davies with the morphology of England and Wales, and with the Jurassic and Cretaceous rocks of Britain, except portions of the Scottish Jurassics which are described by Prof. P. G. H. Boswell along with the Scottish Trias; Prof. O. T. Jones with the Silurian; Dr. J. W. Evans with the Devonian; Prof. P. F. Kendall with the Carboniferous, Permian, and Quaternary deposits; Mr. L. Richardson with the Trias and Rhætic; Mr. H. J. Osborne White with the Upper Cretaceous and Tertiary; Prof. G. A. J. Cole with the whole of the Irish formations and with Irish morphology; and Mr. J. Parkinson with the Channel Islands. Room is also found for a short chapter on British earthquakes by Dr. C. Davison.

It is inevitable that there will be many individual points in an embracing work of this kind on which one reader or another will feel inclined to challenge the authority; one might take exception, for example, to the inclusion of the Albion in the Lower Cretaceous, after the unfamiliar German practice, and to the unwarranted implica-

tion here and there that German usage is equivalent to "Continental usage." But we have no space for criticism of detail, which would, indeed, in most cases resolve itself merely into the statement of difference of opinion upon minor points. We commend the book to the attention of every advanced student of British geology.

G. W. L.

Chemical Research in the Elementary Laboratory.

The Experimental Basis of Chemistry: Suggestions for a Series of Experiments Illustrative of the Fundamental Principles of Chemistry. By Ida Freund. Edited by A. Hutchinson and M. Beatrice Thomas. Pp. xvi+408. (Cambridge: At the University Press, 1920.) 30s. net.

MISS FREUND'S "Study of Chemical Composition" has established for itself a position in chemical literature which has many of the elements of permanence, mainly because of the abiding charm and freshness of the contact which it gives with the great pioneers of chemical discovery. To repeat this successful adventure in a laboratory manual of practical chemistry would appear to be a much more formidable task; but the ten chapters on "The Experimental Basis of Chemistry" which have been prepared for the Press by Mr. Hutchinson and Miss Thomas demonstrate the value, even in an elementary laboratory, of an intimate knowledge of and love for chemical literature.

The earlier portions of the book are of a missionary character. The gospel preached is that knowledge comes only by labour, and that the hasty and inexact work of a beginner is too insecure a foundation on which to base the laws of chemistry. The latter must be derived from the painstaking and exact work of the great masters of the science. In particular a protest is made against those aspects of the "heuristic" method of teaching in which the student is expected to discover in class laws and facts which would demand months and years of work if the discovery were only genuine. Even to prove the correctness of these laws and facts is usually beyond the ability of the worker, and all that is really possible is to work out (in the words of the sub-title) "a series of experiments illustrative of the fundamental principles of chemistry."

The experiments selected for this purpose include a considerable number which are new in form or method; but a more important feature of the book is the discussion of the limits of error as revealed by a comparison of the results of indi-

vidual workers with one another and with the results attained in the most exact researches. This leads up to a consideration of the conclusions that can be drawn from the work, or of the additional experiments that must be made before any conclusions can be drawn.

It is to be feared that those teachers who most need the stimulus and the criticisms of this book will be the last to read it; but many younger teachers, who have already tasted of the tree of knowledge, will find in the book fresh inspiration for the study of chemical discovery, and guidance as to its application in the daily routine of the school.

T. M. L.

Cocoa and Chocolate.

Cocoa and Chocolate: Their History from Plantation to Consumer, by Arthur W. Knapp. Pp. xii+210. (London: Chapman and Hall, Ltd., 1920.) 12s. 6d. net.

MR. A. B. WALKLEY has recently explained in his inimitable fashion how the whole future of the drama and dramatic art in England depends on the withdrawal of the rule that chocolates must not be sold in theatres after 8 p.m. A commodity which has such a profound, if indirect, influence on an important phase of English culture merits serious treatment, and it was clearly time that the history of cocoa and chocolate should be written, and written in a popular fashion.

When, about 1735, Linnæus coined for the cacao tree the picturesque name of *Theobroma cacao*, the English chocolate-making industry had been in existence about seven years. It made slow progress in its early days, and 100 years after its inception the imports of cacao beans amounted to only 450 tons per annum. Since then, and especially in the last ten years, the rise has been remarkable, the imports of the raw material for home consumption in 1919 being over 64,000 tons. In addition, there are considerable imports of foreign-made cocoa and chocolate. The chocolate-maker has, therefore, no reason to complain of the descent of chocolate from its lofty estate as a food of the "gods" to the more humble condition of the flapper's confection.

Mr. Knapp is connected with an enterprise which not only makes everything that can be made from cacao beans, but also owns plantations of cacao trees. He has had, therefore, unique opportunities of making himself acquainted with every branch of the industry, and he has clearly not only utilised these opportunities to the full, but also has thought to some purpose about the

numerous unsolved problems connected with cacao-planting and the preparation of the beans for the market. There must be few planters whose ideas on the shading of cacao trees, the fermentation of the beans and the characteristics of a good cacao will not be clarified by a perusal of Mr. Knapp's pages.

Though chocolate is regarded by the ordinary person as a luxury, it has always had a band of devotees, who regard it as an important food-stuff. Mr. Knapp is one of these enthusiasts, and he provides the inevitable table, comparing the "fuel value" of chocolate with those of some ordinary foods. He omits, however, all reference to price per calorie, which would bring out the interesting fact that even plain chocolate is an expensive food, and that when consumed in the form of those super-confections which, if one may judge from the contents of chocolate-shop windows, constitute the bulk of the chocolate consumed to-day, it is a very expensive food—in fact, as the plain man believes, a luxury. The author of so interesting a book as this may, however, be forgiven a trifling obsession of this kind. It is a book which should be in the hands of all officials of tropical agricultural departments (for whose experimental work Mr. Knapp expresses much admiration) and of all cacao planters, and it is so simply and clearly written that it might even be read by the chocolate consumer if there were in this country any adequate machinery for making the existence of interesting technical literature known to the general public. The illustrations are numerous, good and well selected.

T. A. H.

Our Bookshelf.

An Introduction to Combinatory Analysis. By Major P. A. MacMahon. Pp. viii+71. (Cambridge: At the University Press, 1920.) 7s. 6d. net.

In this little book Major P. A. MacMahon has given a short introduction to his two volumes on combinatory analysis which were published in 1915-16. The theories of combination, permutation, arrangement, order, and distribution which are dealt with in those volumes present technical difficulties; it is, therefore, a great advantage that such an introduction should exist, for the gradual development of the subject by easy stages will prove interesting to the reader and whet his appetite for the larger tomes which await him.

In the first chapter the elementary theory of symmetric functions is introduced, and on it the theory of distributions is afterwards based. The author treats in turn the simplest problems of the distribution of objects into boxes, one object